

# UAV components in mass production:

## From compact quadcopters to core components in large drones, HP MJF delivers performance and cost advantages

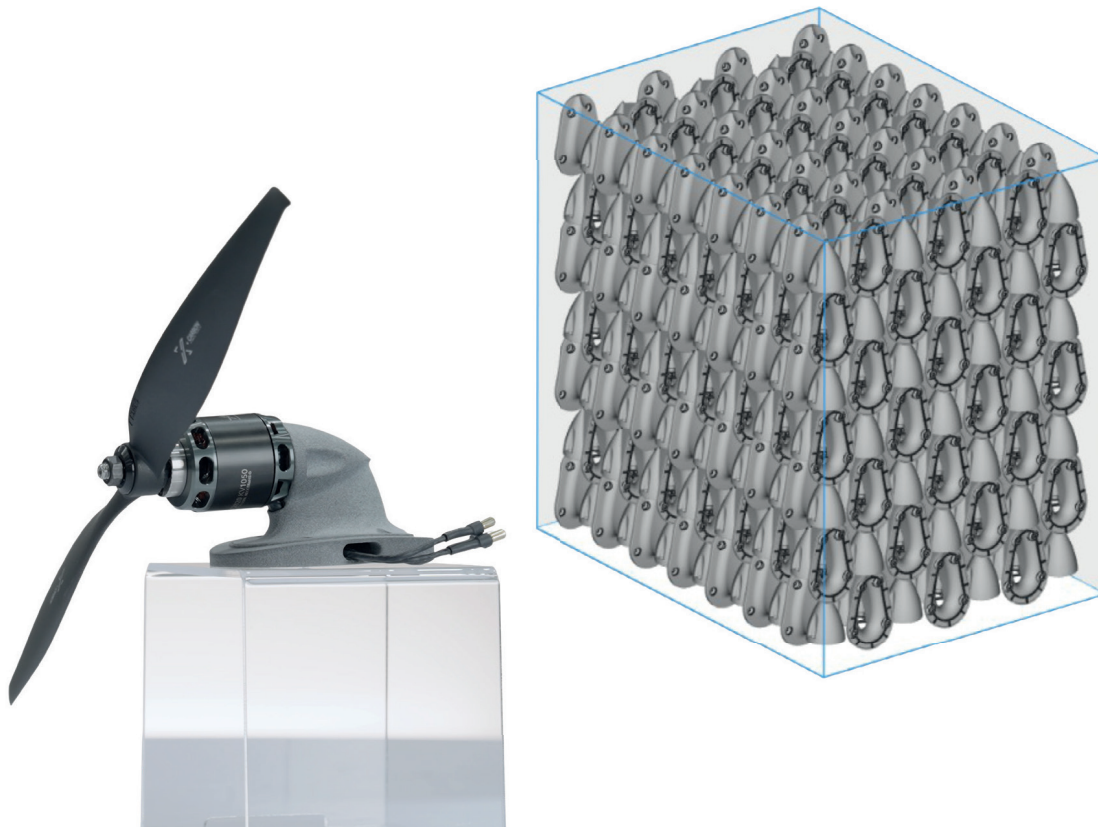


The HP Jet Fusion 5600 series delivers exceptional quality throughput, while HP 3D High Reusability PA 12 enabled by Evonik ensures isotropic performance. When combined, these innovations unlock scalable production of both small and large drone components, while setting new lightweight benchmarks.

In this paper, we examine fundamental components for small quadcopter drones as well as dimensionally compatible parts used in Category 1 and larger drone systems. These elements can be integrated within control surfaces or external components including the fuselage or wings. This document also highlights the lightweight advantages of PA12 material produced with HP MJF, demonstrates the scalability of small components, and compares cost competitiveness against injection-molded parts. To illustrate these points, we reference two educational case studies developed by the HP team that provide benchmarks regarding weight, volume, and cost. In addition, we remind readers that HP offers specialized training and design support services that help customers fully leverage MJF technology, optimizing both performance and cost efficiency.

## Use case 1: Drone engines mounts optimized for HP MJF

HP Multi Jet Fusion technology is particularly well-suited for small unmanned aerial vehicle (UAV) parts, specifically those components which can be efficiently nested within a 380×284×380 millimeter build volume. Elongated and volumetric shapes, comparable in size to everyday objects such as pens, matchboxes, smartphones, or soda cans, can be arranged with high packing efficiency, which streamlines production times and lowers overall cost per part. Many UAV components fit within these dimensions and can be produced with superior efficiency, including internal and external systems such as engine mounts, brackets, battery clips, and camera fairings. Manufacturing these types of parts with MJF eliminates the need for expensive molds, achieving lower cost-per-part and greater flexibility across the supply chain.



Demonstrating this capability, HP redesigned an engine mount for a fixed-wing drone. To support scalable production, other solutions required structures with external covers, screws, and joining techniques. HP's approach, however, combines MJF technology with deep process understanding, addressing functional requirements and system pain points. As a result, UAV manufacturers gain significant advantages including a lightweight 9 gram structure, integrated aerodynamic fairing (1), sacrificial wiring features for easier assembly (2), part consolidation (3), reduced screw usage (4), and a highly competitive total cost of ownership (TCO) that minimizes manual labor.

The design team optimized the mount with a slender, aerodynamic, and nestable geometry that enabled up to 366 parts per build. This translates to internal production costs as low as \$ per part and annual printer throughput exceeding 180,000 parts on the MJF 5600 series platform

## Use case 2: MJF redefines quadcopter airframe cost efficiency

For moderate production volumes, HP Multi Jet Fusion technology offers a powerful alternative to injection-molding. By eliminating the need for tooling, MJF dramatically reduces lead times and upfront investment. This makes it especially well-suited for mid-volume manufacturing, rapid prototyping, and frequent design iterations, delivering mechanical performance and cost competitiveness without compromise.

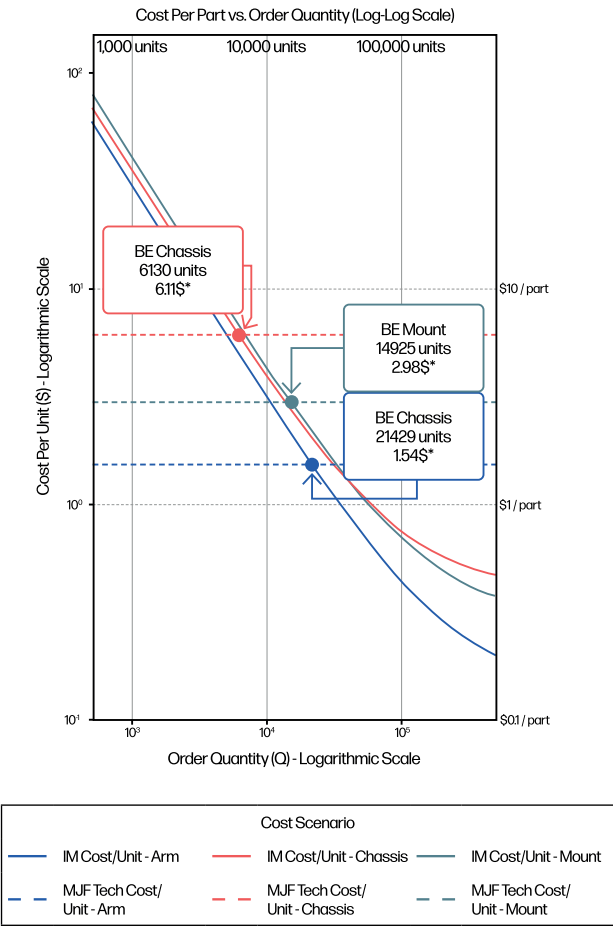


To showcase this capability, we designed a quadcopter airframe that optimizes technical capabilities, performance, and cost-effectiveness. With smart partitioning that combines four arms with a single electronics chassis, this 260-millimeter quadcopter can be assembled in seconds. Each MJF print build totals 655 parts, including 524 arms and 131 chassis, translating into a capacity exceeding 200 drones per day, or more than 60,000 drones annually per printer.

Cost efficiency is equally compelling: fully burdened internal production estimates that include real estate, energy, supplies, and manufacturing overhead factor each arm at \$1.54\* and each chassis at \$6.11\*, resulting in a total airframe cost of just \$765\*. Even when outsourcing internationally, which can raise purchasing costs, depending on supplier pricing, taxes, and logistics, the units can be purchased for below \$10-15\* each.

In this exercise, experts also compared HP MJF with traditional injection molding, analyzing the costs of producing a quadcopter system with four arms and one chassis. Injection molding requires an investment in two molds and needs a minimum of 6,130 chassis and 21,429 arms to achieve a breakeven.

The following table and graph present the theoretical cost analysis and breakeven comparison against traditional injection molding:



| Part Name                                          | Arm           | Chassis      | Mount        |
|----------------------------------------------------|---------------|--------------|--------------|
| Manufacturing complexity                           | high          | medium       | high         |
| Weight (grams)                                     | 2.4           | 11.9         | 7.6          |
| Bounding box size (x, y, z)                        | (107, 18, 33) | (61, 40, 94) | (70, 48, 46) |
| Mold fix cost \$                                   | \$ 30,000*    | \$ 35,000*   | \$ 40,000*   |
| Estimated injection molding cost for 500 units     | \$ 60.14*     | \$ 70.40*    | \$ 80.30*    |
| Estimated injection molding cost for 10,000 units  | \$ 3.14*      | \$ 3.90*     | \$ 4.30*     |
| Estimated injection molding cost for 100,000 units | \$ 0.44*      | \$ 0.75*     | \$ 0.70*     |
| Estimated injection molding cost for 500,000 units | \$ 0.20*      | \$ 0.47*     | \$ 0.38*     |
| MJF technology                                     | \$ 1.54*      | \$ 6.11*     | \$ 2.98*     |
| Beackeven quantity (units)                         | 21,429        | 6,130        | 14,925       |

Beyond pricing, HP’s additive manufacturing technology also offers a decisive advantage in flexibility, providing a streamlined digital workflow that allows rapid development and iteration, without the delays and costs associated with revamped tooling. In addition, MJF enables certain unique features and functionalities that can’t be achieved with injection molding, allowing drone manufacturers to minimize wall thickness and utilize advanced lattice structures to further lighten weight and optimize their products for performance and payload capacity.

Additional resources:

Paper A: Achieve New Heights with HP Multi Jet Fusion (MJF) Technology

Paper C: HP MJF Outperforms Conventional Approaches for Making Category I Fixed-Wing Drones

For more information, please visit the HP Drones website: [www.hp.com/drones](http://www.hp.com/drones) or contact us: [drones@hp.com](mailto:drones@hp.com)

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